Surface acoustic wave sensor

Field of the invention

The invention relates to a surface acoustic wave sensor which can be checked without the use of wires.

Background to the invention

Surface acoustic wave sensors (SAW sensors) which can be checked without the use of wires are nowadays used in many fields, since these sensors can transmit measurement data without the use of wires, and without their own power supply. Sensors such as these have thus already been used for a long time for pressure measurement, acceleration measurement, surface tension measurement and for the measurement of chemical characteristics. Since the measurement results from this surface acoustic wave sensor are temperature-dependent, temperature compensation must be carried out when transmitting the measurement result, in order to make it possible to deduce the actual measured values. One such surface acoustic wave sensor is described in EP-0619 906 B1. This document likewise discloses a method describing how the current temperature of the sensor can be determined from the radio signals that are sent back. The measurement result can be corrected for the temperature influence with the aid of this temperature information. The problem in this document is that two or more SAW sensors are required for the method

described there.

Object of the invention

The object of the invention is thus to specify a surface acoustic wave sensor in which temperature determination and compensation can be carried out using very simple methods.

Description of the invention

The object is achieved by the features in the characterizing part of claim 1.

The essence of the invention is that an edge area of the chip surface which is neither expanded nor compressed when mechanical loads are applied is used to produce a temperature difference signal. Two reflectors are incorporated in this smoothed edge zone of the SAW sensor, a short distance apart, for this purpose. Since these two reflectors are always at the same distance apart from one another irrespective of the mechanical load on the sensor, the temperature of the chip can be deduced directly from the difference signal between these two reflectors. This simple measure means that all that is necessary is to evaluate the time interval between these two signals. This time interval is then directly proportional to the current temperature of the SAW sensor.

Comprehensive description of the drawing

Figure 1 shows a plan view of a surface acoustic wave sensor 1. This surface acoustic wave sensor is applied to the surface of the part to be measured, via adhesive. The adhesive 2 elastically transmits the length changes of the part to be measured to the surface acoustic wave sensor. The antenna 3 via which the electromagnetic pulses are passed to the SAW sensor and are sent back again is illustrated schematically on the sensor. These electromagnetic waves are converted by the transducer 4 to mechanical waves, which run over the SAW sensor. Depending on the object to be measured, reflectors 5a, 5b are fitted on the surface acoustic wave sensor. The area which is mechanically expanded and compressed during measurement tasks on this sensor is provided with the reference symbol 7. The two edge areas 8 of the surface acoustic wave sensor are areas which are not expanded or compressed, owing to the mechanical characteristics of the adhesive and of the substrate material.

Reflectors 6a and 6b are arranged in this edge area 8. The distance between the reflectors 6a and 6b is very largely independent of the external load, and is thus always virtually constant. Practical trials have shown that this smoothed area 8 corresponds approximately to three times the thickness of the substrate material of the SAW sensor. One possible way to enlarge the smoothed edge area 8 is to

deliberately omit the adhesive 2, by means of which the surface acoustic wave sensor is applied to the substrate material, in the edge area 8. No forces are transmitted in the area without adhesive 10.

Figure 2 illustrates the measurement result for a surface acoustic wave sensor which has been bonded onto a substrate material which has been extended for trial purposes. The measurement points along the surface acoustic wave sensor are plotted on the abscissa of this graph. The expansion of the surface acoustic wave sensor is illustrated on the ordinate of this graph. The two smoothed edge zones 8 in which the sensor does not extend when loaded are represented by horizontal lines. The area 7, which responds in proportion to the expansion of the material to be measured is located between these lines. These additional reflectors are arranged in the area of the smoothed edge zones 8.

List of reference symbols

1. Surface acoustic wave sensor
2. Adhesive
3. Antenna
4. Transducer
5. 5a, 5b reflectors for the measurement task
6. 6a, 6b reflectors for temperature compensation
7. Expanding area of the SAW sensor
8. Smoothed edge zone of the SAW sensor
9. Thickness of the substrate material of the SAW sensor
10. Area without adhesive (optional)